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C. V. RILEY,
Washington,
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Contributions from the

SHAW SCHOOL OF BOTANY.

No. 4.

TRELEASE ON CEANOTHUS.

(Proc. Cal. Acad. Sci., 2d Ser., Vol. I, Part. 1. Issued June 15, 1888.)

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CONTRIBUTIONS FROM THE SHAW SCHOOL OF BOTANY.

No. 4.

SYNOPTICAL LIST OF NORTH AMERICAN SPECIES OF CEANOTHUS.

By William Trelease.

In its present limitation, *Ceanothus* is an exclusively American genus, and all but three of the species known to me occur north of Mexico. It is quite puzzling to the student of our flora, partly because of the variability of some species, and partly because in some instances what are evidently distinct species approach each other so closely as to render their characterization difficult, although they may be pretty surely recognized by the practiced eye. To the evolutionist, these groups of interlocking sub-species and barely distinguishable species, are interesting as representing different stages in the mutations of their prototypes; but they are exceedingly trying to the systematic botanist, whose task is to so arrange and limit them as to render their recognition by others easy.

Aside from the monograph of the genus (in the broader sense in which it was formerly understood) in De Candolle's Prodromus, which characterizes very few of the species that are now known, and the fuller revision in the first volume of Torrey and Gray's Flora, it has been very judiciously and completely treated by Mr. Watson in a revision of the entire group (Proc. Amer. Acad. x. 1875, 333-9), and a separate elaboration of the numerous and difficult Californian species (Bot. Cal. i. 102-104; ii. 439). His views on the synonymy of species are also very fully indicated in his Bibliographical Index to North American Botany. Nor should the field notes of the keen-sighted Nuttall, on a number of the Pacific Coast species, in Torrey and Gray's Flora, be overlooked.

2d Ser. Vol. I. Issued June 15, 1888.

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In the main, the limitation and descriptions of species in Mr. Watson's monograph, and his references to literature, in the Index, are so accurate as to require little alteration; but after repeatedly going over the genus as represented in the Gray, Engelmann, and Torrey herbaria, and in the extensive collections of the California Academy of Science, and the United States Department of Agriculture, as well as the fine private herbarium of Mr. J. C. Martindale, it has seemed to me that *Ceanothus* is capable of subdivision into more natural groups than have yet been proposed, and the following is offered as a tentative arrangement of our species, I shall be very grateful for specimens and notes elucidating doubtful species, and I desire here to express my obligation to the botanists who have already placed public or private collections in my hands for study.

A. Leaves alternate, not spinescent, glandular-toothed or occasionally entire; stipules thin, often subulate, fugacious; fruit sometimes keeled or crested on the back of each segment, but not bearing prominent dorsal horns.—*Euceanothus.*

a. Inflorescence on leafless lateral peduncles borne on the old wood.

1. C. SANGUINEUS, Pursh. Fl. Am. Sept. i. 167; Watson, Proc. *l. c.* 334, Index, 166.—British Columbia to Idaho and California.

b. Inflorescence on leafy shoots of the present season's growth.

* Flowers white, in small simple corymbose clusters terminating mostly leafy spineless twigs: leaves very small (2 to 8 mm. long), 3-nerved.—Atlantic species.

2. C. MICROPHYLLUS, Michx. Fl. i. 154; Watson, *l. c.* 335. Georgia to Florida.

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3. C. SERPYLLIFOLIUS, Nutt. Gen. i. 154; Watson, *l. c.* 335.—Georgia. The locality in Nuttall's Genera, and on an original specimen in the Gray herbarium, is Florida.

* * Flowers white: inflorescence rather simple and mostly compact, at the ends of slender usually leafless or nearly leafless peduncles: twigs subterete, not spinose: leaves ample or medium-sized (15 to 75 mm. long), thin, toothed, 3-nerved: fruit about 4 mm. in diameter. — Atlantic or Rocky Mountain species.

4. C. AMERICANUS, L. Spec. 195; Watson, *l. c.* 333, Index, 163.—Ontario to Manitoba, south to Florida and Texas.

5. C. OVATUS, Desf. Arb. ii. 381; Watson, *l. c.* 334.—Canada and the lake region to Texas.

VAR. PUBESCENS, Watson, Index, 166.— Rocky Mountain region.

* * * Flowers blue: inflorescence compound, ample, on leafy branches: twigs conspicuously sulcate: leaves medium-sized (25 to 50 mm. long), prominently 3-ribbed, minutely glandular-serrulate: fruit mostly 5 or 6 mm. in diameter.

6. C. THYRSIFLORUS, Esch. Mem. St. Petersb. Acad. x. 285; Watson, *l. c.* 334.—Mountains of Western California.

* * * * Flowers blue (often pale) or white: inflorescence compound, rather loose, on few-leaved branches: leaves entire, mostly medium-sized.—Pacific species.

+ Twigs (more or less spinose in the first) usually somewhat angled and often twisted: leaves rather firm or even coriaceous.

++ Leaves rather broad, not at all 3-nerved: fruit 5 to 6 mm. in diameter.

7. C. SPINOSUS, Nutt. in Torrey & Gray, Fl. i. 267; Watson, *l. c.* 337.—Middle and Southern California.

8. C. PALMERI, n. sp. Glabrous throughout, or a very few hairs on the leaves and petioles: branches greenish, becoming brown: leaves mostly on short spurs, slender-petioled, about 40 mm. long, elliptical or ovate-oblong, rounded at both ends, mucronate or emarginate, entire, thinner than in the last: flowering branches ascending, naked or few-leaved: inflorescence oblong, nearly simple: exocarp of fruit rather fleshy. — Mountains of Southern California (*Palmer*, 1875, No. 42). Intermediate between *C. spinosus* and *C. integerrimus*.

++ ++ Leaves narrow, 3-nerved, the nerves often concealed by the revolute margins; fruit about 3 mm. in diameter.

9. C. PARRYI, n. sp. Branches glabrate or sparingly villous, strongly sulcate, more or less papillate: leaves narrowly elliptical-oblong, obtuse, 15×30 mm. or less, glandular-serrulate, glabrous above, the lower surface rusty-tomentose, at least along the veins: inflorescence oblong, interrupted, terminating recurved-ascending slender, few-leaved branches: flowers blue.—Known to me only from specimens found in cultivation at Calistoga, Cal. (*Parry*, 1881, No. 33).

+ + Twigs not spinose nor rigid, very slightly angled while young: leaves thinner, at least the largest 3-nerved: inflorescence rather dense for the group; fruit about 4 mm. in diameter.

10. C. INTEGERRIMUS, Hook. & Arn. Bot. Beechey, 329; Watson, *l. c.* 334, Index, 165. *C. thyrsiflorus*, var. *macrothyrsus*, Torrey, Bot. Wilkes, 263! California to Arizona.

11. C. PARVIFOLIUS. *C. integerrimus*, var.? *parvifolius*, Watson, *l. c.* 334.—California to Oregon.

***** Flowers blue or white: inflorescence mostly compound and ample: leaves generally medium-sized to large 3-nerved; margin various.

+ Twigs not spinose nor conspicuously glaucous, the youngest angled in the first species: flowering-branches few-leaved or leafless: leaves broad, usually large (25 to 75 mm. long): fruit about 5 mm. in diameter.

12. C. ARBOREUS, Greene, Bull. Cal. Acad. ii. 144. *C. sorediatus*, Lyon. Bot. Gaz. xi. 204, 333.—Islands off the Californian Coast.

14. C. VELUTINUS, Dougl. in Hook. Fl. Bot.—Am. i. 125, pl. 45; Watson, *l. c.* 334.—British America to California, Colorado and Nebraska, chiefly in the mountains.

VAR. LÆVIGATUS, Torr. & Gray, Fl. i. 686; Watson, Index, 167.—Range of the species.

+ + Twigs terete, often very divergent and rigid, some of them ending in firm spines.

++ Twigs short, often very glaucous: leaves large in the first, mostly medium-sized, rather small in the last: fruit 4 to 6 mm. in diameter.

14. C. INCANUS, Torr. & Gray, Fl. i. 265; Watson, *l. c.* 336.—California.

15. C. EGLANDULOSUS. *C. divaricatus*, var. *eglandulosus*, Torrey, Pac. R. R. Rep. iv. 75. *C. divaricatus*, Watson, *l. c.* in part.—Mountains of California and Lower California.

16. C. DIVARICATUS, Nutt. in Torr. & Gray Fl. i. 266, 686; Watson, *l. c.* 336 in part. —California and Lower California.

VAR. GROSSE-SERRATUS, Torrey, Pac. R. R. Rep. iv. 75. —California.

17. C. CORDULATUS, Kellogg, Proc. Cal. Acad. ii. 124, f. 39; Watson, *l. c.* 337.—Mountains of California.

++ ++ Twigs slender, usually slightly if at all glaucous: spines slender and sharp: leaves rather narrow for the group: fruit about 4 mm. in diameter.

18. C. FENDLERI, Gray, Pl. Fendler 29; Watson, *l. c.* 337. Mountains of Colorado, New Mexico and Arizona.

VAR. VIRIDIS Gray, in Herb. — Arizona (*Lemmon. Greene*).

‡ ‡ ‡ Flowers deep blue (except sometimes in the first), in rather compact nearly simple corymbose or oblong clusters, on leafless or nearly leafless (sometimes abbreviated), usually scaly peduncles: twigs terete, mostly spineless, and not very rigid.—Pacific species.

+ Leaves medium-sized, all or nearly all 3-nerved: twigs rather more rigid in forms of the first two than elsewhere in this group: fruit about 4 mm. in diameter.

19. C. SOREDIATUS, Hook & Arn. Bot. Beechey, 328; Watson, *l. c.* 336. —Coast Range of Southern California, extending into Lower California.

20. C. HIRSUTUS, Nutt. in Torr. & Gray, Fl. i. 266; Watson, *l. c.* 336. *C. diversifolius* Kellogg, Proc. Cal. Acad. i. 58, 65.—Mountains of Southwestern California.

VAR. ? GLABER, Watson, *l. c.* 336. —East Humboldt mountains, Arizona. (Watson, No. 212.)

21. C. DECUMBENS, Watson, *l. c.* 335.—Mountains of Central California.

++ Leaves usually small, commonly only the largest 3-nerved, not papillate: fruit 3 mm. in diameter.

22. C. DENTATUS, Torr. & Gray, Fl. i. 268, Watson *l. c.* 335.—Coast range of Southern California.

SUBSP. ? FLORIBUNDUS. *C. floribundus* Hook. Bot. Mag. pl. 4806; Watson, *l. c.* 338.—Known certainly only from plants grown in European gardens, from Californian seed.

SUBSP. ? LOBBIANUS. *C. Lobbianus*, Hook. Bot. Mag. pl. 4810.—Coast Range of Southern California.

23. C. IMPRESSUS, n. sp. Villous, with short spreading hairs: leaves broadly elliptical to nearly orbicular, 6 to 8 mm. long, loosely villous, especially on the veins below, the upper surface deeply furrowed over the midrib and several pairs of lateral nerves, the slightly glandular margin very revolute, appearing there as if crenate: peduncles about 10 mm. long, scaly toward the base: inflorescence sub-globose, compact: fruit not seen.—Santa Barbara County, Cal.

+++ Leaves medium-sized, oblong, not at all 3-nerved, papillate.

24. C. PAPILLOSUS, Torr. & Gray, Fl. i. 268; Watson, *l. c.* 337.—Mountains of Western California.

25. C. VEATCHIANUS, Hook. Bot. Mag. pl. 5127; Watson, *l. c.* 338.—Decribed and known only from European plants raised from Californian seed.

B. Leaves opposite or alternate, pinnately veined, coriaceous, often pungently toothed; stipules thick and spongy, taper-pointed persistent: inflorescence densely corymbose, on short spurs from the new wood; fruit usually large for the genus, each carpel commonly bearing a dorsal horn, an alternating set, of 3 crests or horns frequently at or near the apex.—*Cerastes*

Species of the Pacific Coast or Southwest, mostly with rigid almost spinose twigs.

a. Procumbent and radicant: flowers bright blue (except occasional albinos or hybrids), mostly on long, slender, colored pedicels.

26. C. PROSTRATUS, Benth. Pl. Hartweg, 302; Watson, *l. c.* 339.—Washington Ter. to California and Nevada.

b. Erect or spreading, the branches mostly rigid: pedicels usually stouter or rather short.

* Leaves opposite.

+ Flowers (always?) white.

27. C. CUNEATUS, Nutt. in Torr. & Gray, Fl. i. 267; Watson, *l. c.* 338 and Index, 164, in part. — Oregon to Lower California.

28. C. GREGGII, Gray, Plant. Wright. ii. 28; Watson, *l. c.* 338.—Utah, Arizona and New Mexico to Mexico.

29. C. CRASSIFOLIUS, Torr. Pac. R. R. Rep. iv. 75; Watson, *l. c.* 338 and Index, 164, excl. synonym and variety. —Coast range of Southern California, Lower California and Californian islands.

++ Flowers blue (or rose-purple?).

30. C. RIGIDUS, Nutt. in Torr. & Gray, Fl. i. 268; Watson, *l. c.* 339.—Coast region of Southern California.

VAR GRANDIFOLIUS, Torr. Pac. R. R. Rep., iv. 75; Watson, Index, 164, under *C. crassifolius*. *C. crassifolius*, var. *glabratus* Gray, Cat. Bolander, 8; Watson, Index, 164.—Range of the species.

** Leaves alternate; flowers white.

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31. C. VERRUCOSUS, Nutt. in Torr. & Gray, Fl. i. 267; Greene, Bull. Cal. Acad. ii. 81. *C. cuneatus*, Watson, *l.c.* 338, and Index, 164, in part.—Southern California and Lower California.

32. C. MACROCARPUS, Nutt. in Torr. & Gray Fl. i. 267; Greene, *l. c. C. cuneatus*, Watson, *l. c.* 338, and Index, 164, in part.—Coast Range of Middle and Southern California.

NOTES.

C. sanguineus appears to differ from all other species of the genus in flowering from wood of the preceding season's growth; otherwise, it is related in several respects to Nos. 4 and 5.

C. microphyllus and *serpyllifolius*—very closely related to each other—show no very great affinity for other groups. For convenience they are placed where they now stand, although in the character of the inflorescence, they approach the *dentatus* group. I have no fruit of either.

While *C. ovatus* is well marked in its typical Eastern form, it passes gradually into var. *pubescens* in the West, and through this approaches *Americanus* in its leaf-forms. The leafiness of flowering branches is sometimes quite variable.

In *C. spinosus*, the firm leaves commonly turn brown in drying, especially the upper surface; the branches of the ample somewhat leafy loose thyrsus mostly spread at right angles or are even recurved; and the flowers are scarcely more than lilac-colored.

C. parvifolius appears to be distinct from *integerrimus* in its loose low habit, smaller leaves scarcely exceeding 25 mm. in length, the majority of them not 3-nerved, and in its smaller oblong or (from the falling of the lower fascicles) subcorymbose inflorescence of blue flowers—those of *integerrimus* appearing to be always white.

C. arboreus is, as Professor Greene has shown, the largest of our species. It was collected on Sta. Catalina many years ago, by Nuttall, who notes its arboreous habit on the label accompanying a specimen in the herbarium of the Philadelphia Academy.

Numbers 14 to 17 of the list are quite difficult to distinguish.

C. incanus, with large, rather thin, nearly smooth elliptical leaves, often rounded in abruptly to the lateral nerves, a short distance above ths base, usually entire, pale below; rather large white flowers (often 5 or 6 mm. in expanse); and large depressed fruit with a more fleshy exocarp than usual, is generally recognized without much difficulty. The same is true of *C. eglandulosus*, which is nearly glabrous and very glaucous, with rather small strongly ovate entire or nearly entire leaves, usually brown above, in herbarium specimens; and smaller dingy blue flowers. But *divaricatus* and *cordulatus* approach each other so closely that it is hard to draw the line between them. The specimens with smaller, thicker leaves are commonly referred to the latter, as being evidently what Kellogg figured, while the former species usually has large and more flexible leaves.

C. Fendleri, with rather thin narrower leaves, silky-canescent in the type, green and nearly glabrous in the variety; stands out quite well from its congeners, in geographical distribution, also.

C soredlatus is a species which I do not at all understand. As it is here accepted, it includes plants with slender rather simple twigs, and others that are quite rigid and intricately branched; the leaves of some are very broadly ovate, while others are narrower; and the pubescence varies from silky or more or less hirsute to very densely white- or rusty-tomentose on the lower surface of the leaves. The inflorescence is intermediate between that of the preceding and following groups of species. In some of the rather slender-stemmed plants that I regard as most typical, the twigs are very rough with crowded small warts. Probably one or more species may ultimately be separated out, and it is not certain that a number of specimens now referred here do not really belong to *divaricatus* on the one hand, or *hirsutus* on the other.

The *dentatus* group is one of the best circumscribed, but it is not less puzzling than others, for it is doubtful whether the forms it comprises are best described as species or varieties. *Lobbianus* is chiefly characterized by its conspicuously unequal leaves—those on the primary shoots 25 mm. long, mostly acute at both ends, the larger 3-nerved.

While I have scarcely felt that this form and *floribundus* are worthy of specific rank, I have pretty confidently separated out the plant with rather broad hairy leaves, deeply furrowed over the veins. It is known to me only from two flowering specimens in the Gray herbarium, collected at different places.

In CERASTES the species are quite as perplexing as in EUCEANOTHUS, and the difficulty of separating them is increased by the occurrence of what appear to be hybrids. This is especially true of *prostratus* and *cuneatus*, typically very distinct in habit, foliage, flowers and fruit; but numerous specimens have been collected over a large area, showing various combinations of the characters of both. So marked are these that Mr. Thomas Howell writes me that from his field observations he is disposed to regard *prostratus* as only a variety of *cuneatus*.*

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* On these supposed hybrids, see Garden and Forest, i. 7.

The fruit of *prostratus* is usually considerably longer than broad, about 8 mm. in diameter, rather fleshy, with 3 nearly erect prominent horns, and an accessory set of apical crests or smaller horns.

Cuneatus produces subglobose or very slightly elongated fruit, about 6 mm. in diameter, with thin flesh, and usually 3 rather small horns, an accessory set of smaller ones being occasionally seen.

C. Greggii, closely related to *cuneatus*, is marked by its leaves, often white-tomentose below, mostly equally rounded and acute at both ends, frequently with one or two small teeth on either side, and its rather pointed fruit, about 4 mm. in diameter, seemingly nearly or quite hornless, the white calyx-lobes more persistent than usual.

C. crassifolius, as it is now accepted, is very heterogeneous, embracing plants with entire or toothed smooth green leaves, and others with the leaves pungently toothed, revolute margined, and very white-woolly below. The fruit is as much as 8 or 10 mm. in diameter, depressed-globose, smooth or with 3 low deeply dorsal horns, and the base (invested by the adnate calyx) very prominent, and indurated. The leaves are always firm and thick.

C. rigidus has thinner, often cuneate-obcordate, mostly denticulate leaves, and blue or purplish flowers. Good fruit is desirable. Some specimens suggest hybridization with *C. prostratus*.

C. verrucosus is very similar to *rigidus* in its foliage characters, but with slender twigs, alternate leaves and white flowers. The figure of *rigidus* in Bot. Mex. Bound. pl. 9, is evidently this species. Its fruit is mostly 4 to 6 mm. in diameter, with small dorsal horns, or none.

C. macrocarpus approaches broad-leaved forms of *cuneatus*, and especially entire-leaved forms of *crassifolius*, in its foliage, but its habit is said to be arborescent, its twigs are slender, and its leaves opposite. Its fruit is very similar to that of the entire-leaved *crassifolius*, but with prominent dorsal horns.